

(241)**Experimental Study of Thin Film Sensor Networks for Wind Turbine Blade Damage Detection**

A. Downey¹, **S. Laflamme**¹, F. Ubertini², H Sauder³, and P. Sarkar³, ¹Department of Civil, Construction and Environmental Engineering, Iowa State University, USA; ²Department of Civil and Environmental Engineering, University of Perugia, Italy; ³Department of Aerospace Engineering, Iowa State University, USA

Damage detection of wind turbine blades is difficult due to their complex geometry and large size, for which large deployment of sensing systems is typically not economical. A solution is to develop and deploy dedicated sensor networks fabricated from inexpensive materials and electronics. The authors have recently developed a novel skin-type strain gauge for measuring strain over very large surfaces. The skin, a type of large-area electronics, is constituted from a network of soft elastomeric capacitors. The sensing system is analogous to a biological skin, where local strain can be monitored over a global area. In this paper, we propose the utilization of a dense network of soft elastomeric capacitors to detect, localize, and quantify damage on wind turbine blades. We also leverage mature off the shelf technologies, in particular resistive strain gauges, to augment such dense sensor network with high accuracy data at key locations, therefore constituting a hybrid dense sensor network. The proposed hybrid dense sensor network is installed inside a wind turbine blade 1:25 scale model, and tested in a wind tunnel to simulate an operational environment. Results demonstrate the ability of the hybrid dense sensor network to detect, localize, and quantify damage.